IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	NIELSEN ET AL.	)	EXAMINER:	SZETO, JACK W
SERIAL NUMBER:	10/719,180	)	ART UNIT:	2113
FILING DATE:	NOVEMBER 20, 2003	)		
TITLE:	HOST-INITIATED DATA RECONSTRUCTION FOR IMPROVED RAID READ OPERATIONS	)		

Mail Stop:
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

AFFIDAVIT UNDER 37 C.F.R. SEC. 1.131

Dear Sir:

This affidavit is an Affidavit Under 35 U.S.C. Sec. 1.131. The undersigned co-inventor, Colleen R. Stouffer, was an employee of IBM Corporation ("IBM") at the time this patent application was filed and remains an employee of IBM. This patent application is assigned to IBM.
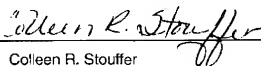
1.   I hereby declare that at the time the present patent application was filed I was an employee of IBM in the United States and I remain an employee of IBM. My position with IBM at that time was Software Engineer. As such, my responsibilities included coding device adapter stage and destage error recovery procedures.

2. I further declare that as part of my responsibilities with IBM, I participated in the conception and reduction to practice of the invention described and claimed in the above-referenced patent application.

3. I further declare that the invention was conceived in the United States at least as early as October 6, 2002, as evidenced by the software change history for IBM's Enterprise Storage Server Model 800 (also known as "Shark") which I acknowledged on that date, attached hereto as Exhibit A. Confidential and irrelevant material has been removed from the software change history and replaced by ellipses. The note describes the problem (data lost when a drive fails to write but the drive does not indicate an error) and the solution (reconstruct the data). The invention was reduced to practice at least as early as January 3, 2003, as evidenced by the notation I added on that date ("Add support for reconstruct read") to the header to the implemented code, attached hereto as Exhibit B. Because the code itself is confidential, it has not been included in the exhibit. Arrows have been inserted in both exhibits to indicate relevant portions of the respective documents.

4. I therefore declare that the information disclosed in U.S. Patent Publication No. 2004/0268178 ("Fredin") is not 35 U.S.C. §102(b) or §103 prior art with respect to the claims of the present patent application since Fredin was filed on June 19, 2003, and the present patent application was conceived in the United States at least as early as October 6, 2002, and reduced to practice at least as early as January 9, 2003. Moreover, the filing data of the present application, November 20, 2003, was within a year of the filing date of Fredin.

Respectfully Submitted,

By: _Colleen R. Stouffer_

Colleen R. Stouffer

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Dear Sir:

This affidavit is an Affidavit Under 35 U.S.C. Sec. 1.131. The undersigned co-inventor, Mr. Karl A. Nielsen, was an employee of IBM Corporation ("IBM") at the time this patent application was filed and remains an employee of IBM. This patent application is assigned to IBM.

1.   I hereby declare that at the time the present patent application was filed I was an employee of IBM in the United States and I remain an employee of IBM. My position with IBM at that time was Senior Engineer. As such, my responsibilities included being one of the technical team leaders on the device adapter team working on IBM storage controllers, such as the Enterprise Storage Server Model 800 (ESS800, also known as "Shark"), with my main focus being the stage/destage part of the code, including the error recovery aspects, and the interface with the RAID controller for storing and retrieving data.

2.   I further declare that as part of my responsibilities with IBM, I participated in the conception and reduction to practice of the invention described and claimed in the above-referenced patent application.

3.   I further declare that the invention was conceived in the United States at least as early as October 6, 2002, as evidenced by the software change history for IBM's ESS 800 acknowledged on that date by co-inventor Colleen R. Stouffer, attached hereto as Exhibit A. Confidential and irrelevant material has been removed from the software change history and replaced by ellipses. The note describes the problem (data lost when a drive fails to write but the drive does not indicate an error) and the solution (reconstruct the data). The invention was reduced to practice at least as early as January 3, 2003, as evidenced by the notation added by Colleen R. Stouffer on that date ("Add support for reconstruct read") to the header to the implemented code, attached hereto as Exhibit B. Because the code itself is confidential, it has not been included in the exhibit. Arrows have been inserted in both exhibits to indicate relevant portions of the respective documents.

4.   I therefore declare that the information disclosed in U.S. Patent Publication No. 2004/0268178 ("Fredin") is not 35 U.S.C. §102(b) or §103 prior art with respect to the claims of the present patent application since Fredin was filed on June 19, 2003, and the present patent application was conceived in the United States at least as early as October 6, 2002, and reduced to practice at least as early as January 9, 2003. Moreover, the filing data of the present application, November 20, 2003, was within a year of the filing date of Fredin.

Respectfully Submitted,

By: _Karl A. Niel_____

Karl A. Nielsen

Date: _20 Sept. 2006_____

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EXHIBIT A: CHANGE HISTORY (REDACTED)

```
prefix      F
name        45823
reference   BB00can3
abstract    DI: ADC hint0906 data corruption (DCR 29847)
duplicate

state       closed
severity    2
age         777

compName    Microcode-da        answer     N/A
release
envName
level

addDate     2001/01/05 19:50:09     assignDate   2002/10/03 11:07:45
lastUpdate  2003/08/05 12:59:56     responseDate 2002/10/03 12:01:40
endDate     2003/02/25 03:00:10

ownerLogin   stouffer            originLogin  fredp
ownerName    Stouffer, Colleen R.    originName   Poole, Fred
ownerArea    7XVA/2D             originArea   CYDA

remoteName                       remoteFamily
target       2002/10/18
product      Shark1.1
targetVrmf   2.1.2
targetFunction
targetPhaseDF
ftdc
systemAttach  N/A
processError
activityODC   Post-GA
triggerODC    N/A
impactODC     N/A
defTypeODC    N/A
qualTypeODC   N/A
sourceODC     N/A
custProbabilit0
customerImpact990
TestDriver
FieldOrigin   US
```

FieldEscape
boxSerialNumbe
tracks:

releaseName	state	addDate	lastUpdate	target
R6g.CPSS	complete	2003/01/08	2003/02/24	2003/02/19

verify:

type	state	addDate	lastUpdate	userLogin	duplicate
duplicate	accept	2001/02/05	2003/02/25	fredp	46880
original	accept	2002/10/03	2003/02/25	fredp	45823

history:

addDate	action	userLogin (userName)
2001/01/05 19:50:09	open	fpoole (Poole, Fred)
2001/01/08 08:19:29	modify	bdclark (Clark, Brian D)
2001/01/08 08:20:20	assign	bdclark (Clark, Brian D)
2001/01/08 08:24:28	note	bdclark (Clark, Brian D)
2001/01/08 08:31:00	assign	garciare (Garcia, Raymond E.)
2001/01/08 10:25:30	note	shunting (Huntington, Steven)
2001/01/08 12:56:41	note	garciare (Garcia, Raymond E.)
2001/01/09 10:38:02	return	garciare (Garcia, Raymond E.)
2001/01/09 10:38:03	note	garciare (Garcia, Raymond E.)
2001/01/17 10:12:05	reopen	fpoole (Poole, Fred)
2001/01/17 11:00:56	assign	garciare (Garcia, Raymond E.)
2001/01/17 19:39:19	note	rschaef (Schaeffer, R.A. (Rick))
2001/01/22 14:16:15	note	fpoole (Poole, Fred)
2001/01/23 09:54:59	note	rschaef (Schaeffer, R.A. (Rick))
2001/01/25 08:20:08	note	fpoole (Poole, Fred)
2001/01/29 14:09:51	note	rschaef (Schaeffer, R.A. (Rick))
2001/01/29 17:47:46	note	rschaef (Schaeffer, R.A. (Rick))
2001/01/30 12:51:40	note	jarvis (Jarvis, Chip)
2001/02/02 08:46:23	note	ayreskj (Ayres, Kate)
2001/02/02 09:29:56	note	rschaef (Schaeffer, R.A. (Rick))
2001/02/05 11:00:50	assign	rschaef (Schaeffer, R.A. (Rick))
2001/02/06 08:49:55	note	ayreskj (Ayres, Kate)
2001/02/07 08:56:14	note	ayreskj (Ayres, Kate)
2001/02/07 12:05:08	note	nielsen (Nielsen, Karl)
2001/02/11 21:00:55	return	nielsen (Nielsen, Karl)
2001/02/14 10:34:52	modify	oubre (Oubre, Rich)
2001/02/16 11:54:30	reopen	nielsen (Nielsen, Karl)
2001/02/16 13:39:54	note	nielsen (Nielsen, Karl)
2001/02/16 13:40:57	modify	nielsen (Nielsen, Karl)
2001/02/27 12:14:57	modify	bdclark (Clark, Brian D)

2001/03/12 08:59:35	note	ayreskj (Ayres, Kate)
2001/03/12 10:41:31	note	nielsen (Nielsen, Karl)
2001/04/19 16:15:48	modify	nielsen (Nielsen, Karl)
2001/05/02 13:49:35	modify	ayreskj (Ayres, Kate)
2001/05/06 19:56:48	note	doublee (Yanes, Juan)
2001/05/07 14:43:23	assign	nielsen (Nielsen, Karl)
2001/05/07 16:06:21	modify	doublee (Yanes, Juan)
2001/05/08 07:52:39	modify	doublee (Yanes, Juan)
2001/07/13 12:14:46	note	nielsen (Nielsen, Karl)
2001/07/13 12:19:23	note	nielsen (Nielsen, Karl)
2001/08/05 12:03:28	modify	doublee (Yanes, Juan)
2001/08/21 07:05:30	modify	doublee (Yanes, Juan)
2001/11/13 06:12:42	modify	doublee (Yanes, Juan)
2001/11/27 04:15:47	modify	doublee (Yanes, Juan)
2001/12/15 01:17:59	modify	doublee (Yanes, Juan)
2002/02/19 06:01:11	modify	doublee (Yanes, Juan)
2002/03/22 10:01:37	modify	bergey (Bergey, Larry)
2002/06/04 13:09:42	modify	oubre (Oubre, Rich)
2002/09/24 19:18:48	modify	nielsen (Nielsen, Karl)
2002/09/30 09:46:06	modify	bergey (Bergey, Larry)
2002/10/03 09:57:52	assign	stouffer (Stouffer, Colleen R.)
2002/10/03 11:07:45	assign	stouffer (Stouffer, Colleen R.)
2002/10/03 11:08:09	modify	stouffer (Stouffer, Colleen R.)
2002/10/03 12:01:40	accept	stouffer (Stouffer, Colleen R.)
2002/10/06 14:06:31	note	stouffer (Stouffer, Colleen R.) ←
2002/10/06 14:23:34	note	stouffer (Stouffer, Colleen R.)
2002/10/07 06:29:08	note	hathorn (Hathorn, Roger)
2002/10/07 11:49:34	modify	stouffer (Stouffer, Colleen R.)
2002/10/13 13:40:36	modify	stouffer (Stouffer, Colleen R.)
2002/10/14 09:47:33	note	stouffer (Stouffer, Colleen R.)
2002/10/18 12:29:37	note	stouffer (Stouffer, Colleen R.)
2002/10/18 12:30:00	modify	stouffer (Stouffer, Colleen R.)
2003/01/08 09:01:40	note	stouffer (Stouffer, Colleen R.)
2003/01/08 13:52:31	note	jarvis (Jarvis, Chip)
2003/02/19 10:12:18	note	stouffer (Stouffer, Colleen R.)
2003/02/19 10:29:43	note	stouffer (Stouffer, Colleen R.)
2003/02/19 15:02:00	note	jarvis (Jarvis, Chip)
2003/02/24 14:13:13	note	jarvis (Jarvis, Chip)
2003/02/24 14:13:26	verify	jarvis (Jarvis, Chip)
2003/02/25 03:00:10	close	fredp (Poole, Fred)
2003/08/05 12:59:56	note	tgriffey (Griffey, Theresa)

...

<Note by stouffer (Stouffer, Colleen R.), 2002/10/06 14:23:33, ←
 seq: 55 rel: 0 action: note>

↓

Request Track Approval:

1. Problem Description:
   There have been field incidents where customers have lost data because a drive in
   the array does not write the data and does not give an error. When the data is
   read, an LRC, CRC, PA or sequence number error is detected. This change will
   allow us to reconstruct the data using the other tracks and the parity track for
   RAID 5 and by reading the mirror for the RAID 10. Hursley has added a new function
   in DCR 29847 that allows us to specify how the data should be read.
2. Impact of Problem to Customer: 990 data loss
3. Frequency of Problem: Relatively infrequent by very serious when it occurs.
4. Fix Description: Using a special function in the adapter firmware, reconstruct
   the data for the failed track.
5. Is this a Design Change? yes for the adapter firmware
   Is a Documentation update required? no
   Enter PCR/FCR/DCR number if applicable. DCR 29847
6. What CMVC number and Link introduced this Problem? This is a drive problem that
   we are attempting to work around.

...

EXHIBIT B: CODE HEADER

```
/*----------------------------------------------------------------------------
** %PS
**
** IBM Confidential
**
** Licensed Internal Code Source Materials
**
** 2105/2107 Licensed Internal Code
**
** (C) Copyright IBM Corp. 1997, 2003
**
** The source code for this program is not published or otherwise
** divested of its trade secrets, irrespective of what has been
** deposited with the U.S. Copyright Office.
** %EPS
**
** Filename: dasdsmederr.c
**
** Subsystem: DA
**
** Description:
**    This file contains the functions needed for performing Medium error
**    recovery.
**
** Function Names:
**    dasdsMedErrGetDumps
**    dasdsMedErr
**    dasdsMedErrBldStg
**    dasdsMedErrStgCmp
**    dasdsMedErrStgCmpSectors
**    dasdsMedErrStgCmpTrack
**    dasdsMedErrNextCdcb
**    dasdsMedErrRecSec
**    dasdsMedErrRecSecCallback
**    dasdsMedErrChkStripeLRC
**    dasdsMedErrChkStripeLRCCallback
**    dasdsMedErrCheckLRCNoMeta
**    dasdsMedErrBldDestg
**    dasdsMedErrDestgCmp
**    dasdsMedErrChkLRCDone
**    dasdsMedErrFinish
**    dasdsMedErrFinishReconstructLog
**    dasdsMedErrSuccessFinishCmp
**    dasdsGetRecoveryResources
```

```
**   dasdsMedErrSetupCDCBQueue
**   dasdsMedErrSetupTCBForBldStage
**   dasdsMedErrRestage
**   dasdsDriveDumpCmplt
**
** Change History:
**   Modifier          Date           Change ID
**   --------------------------------------------------------------
**   Karl Nielsen        19-Jan-1997
**     Created file.
**   Karl Nielsen        13-Feb-1997
**     Add code for increment 2
**   Karl Nielsen        28-Feb-1997
**     Updates from code review
**   Vincent Hsu         20-Apr-97        1496
**     Change OS_PCI_WINDOW_ADDR_SETUP_CACHE Interface
**   Karl Nielsen        06-May-1997      1555
**     Make the rank inaccessible if we get a medium error on write
**   Karl Nielsen        05-Jun-1997      1365
**     Increment 3 intended function and code changes - sense data
**   Mike Vageline       06-Aug-97        2440
**     Add name of anonymous union where needed
**   Mike Vageline       13-Aug-97        2420
**     Set errorRecord.resetCause to DaErrorRecordType for dasdsCallERD(...)
**   Karl Nielsen        04-Sep-97        2688
**     Changes to cdcb and cscb arrays for track buffers
**   Karl Nielsen        03-Dec-97        4201
**     Need to initialize more of the DaReq.
**   Karl Nielsen        10-Dec-97        4455
**     Add kill-strip support
**   Karl Nielsen        11-Jan-98        4716
**     Make sure sector bitmaps are correct before building commands
**   Karl Nielsen        09-Feb-98        5320
**     Allow DA_PARTIAL_COMMAND as a return from dasdsBldCmd
**   Karl Nielsen        17-Feb-98        5609
**     Need Adapter Queue lock when calling dasdsCheckBridgeLRC
**   Karl Nielsen        05-Mar-98        5962
**     Don't use any of the original pointers (TCB,CDCB,etc) for kill strip
**     recovery.  They are all NULL.
**   Karl Nielsen        26-Feb-98        5834
**     Make interface with cache asynchronous.  Use different resources for
**     customer data and metadata.  Partially unquiesce when appropriate.
**   Gail Spear          11-Feb-98        10988
**     Convert rwstatus to a union status.rwstatus
**   Karl Nielsen        07-Jan-99        14049
**     caSDRecoverSectorGetMetaAccess needs TCB ownership
```

```
**  Karl Nielsen        01-Feb-99      14755
**    Be consistent with calls to caSDRecoverSectorGetMetaAccess on FB
**    tracks.  Also change DDR on destage to not check sequence numbers.
**  Karl Nielsen        09-Mar-99      15682
**    Changes from review
**  Karl Nielsen        22-Mar-99      16833
**    Changes from review - consolodate common code
**    Add dasdsGetRecoveryResources
**    Add dasdsMedErrSetupCDCBQueue
**    Add dasdsMedErrSetupTCBForBldStage
**  Karl Nielsen        03-May-99      18392
**    Add PA check when destaging CKD data
**  Karl Nielsen        09-Jun-99      20448
**    Updates to the PA checks.  New function caCheckTrackPADuringRecovery.
**  Matt Kalos          20-Jun-99      20684
**    Set dareq medium recovery flag before calling bldcmd/bldmeta.
**  Karl Nielsen        05-Jul-99      21271
**    Use correct enum type for return from caSDRecoverSectorGetMetaAccess.
**    Set DA_REQUEST_FLAGS_MEDIUM_REPAIR correctly on destage.
**  Karl Nielsen        16-Aug-99      21668
**    Changes to not require meta access to check LRC before destage.
**  Karl Nielsen        19-Aug-99      23647
**    When finishing metadata repair, drive original daReq instead of
**    queueing it on the rank pending queue.
**  Karl Nielsen        08-Sep-99      24827
**    Remove trace into recovery TCB for every failed stage.  Trace just by
**    track results.
**  Karl Nielsen        30-Sep-99      20631
**    Add error log to show which components were affected by the error.
**  Karl Nielsen        02-Nov-99      27117
**    Correct bitmap of affected components.  Data does rotate as well as
**    parity.
**  Karl Nielsen        09-Dec-99      28558
**    Use correct parameters when calling caSDRecoverSector for sequence
**    number errors.
**  Karl Nielsen        21-Mar-00      33327
**    Set DA_REQUEST_FLAGS_MEDIUM_REPAIR before calling dasdsBldCmd.
**  Karl Nielsen        15-May-00      32859
**    Make dasdsMedErrFinish external
**  Larry Bergey        02-Jun-00      28659
**    Ask ErrRA to do warmstart (for trace) at the end of medium error recovery
**  Karl Nielsen        24-Jan-01      43519
**    Get adapter dump on Panic during Recovery if global bit is set
**  Karl Nielsen        11-Jun-01      52637
**    Change so that LRC errors, PA errors, and SeqNum errors found in
**    this path also have ErrRa wait to warmstart until the end of
```

```
**    recovery.
**  Karl Nielsen         02-Aug-01      56278
**    Add CRC checking on CKD tracks.
**  Karl Nielsen         20-Aug-01      50831
**    Changes for RAID-10 - only do single track.
**  Anjul Mathur         17-Sept-2001    58761
**    Remap with R6g(drv20010908_int).
**  Kurt Lovrien         26-Mar-2002    66897
**    Put all DaReqs onto ssa adapter boundary
**  Rich Stelmach        23-Apr-02      69268
**    Change Panic flags to Control Flags
**  Colleen Stouffer     24-Jun-02      74591
**    Remove Bridge LRC support
**  Rich Stelmach        10-Jul-2002    73663
**    Update pointers for 64-bit processor
**  Colleen Stouffer     27-Aug-02      64936
**    REMAP: Clear DA_RW_FLAGS_CHECK_DATA_ON_STAGE flag before
**    redriving the original DaReq.
**    NOTE: According to ca, this flag is only set for
**      a single track (no other CDCBs in the chain).
**  Carlo Hyde           16-Sep-02      60748
**    ADD change to prevent excessive logging by only allowing logs when
**    bitmap is nonzero for function dasdsMedErrFinish
**  Colleen Stouffer     04-Dec-02      75684
**    Add check for cross cluster recovery in dasdsMedErrFinish
**  Carlo Hyde           11-Feb-03      77691
**    Remap Check LRC after repairing CRC on CKD tracks from R9e to
**    R6g
**  Colleen Stouffer     09-Jan-03      45823            ←
**    Add support for reconstruct read. Undo 60748.       ←
**  Colleen Stouffer     03-Mar-03      63715
**    Add call to get drive dumps for stage errors (PCR 2156)
**  Colleen Stouffer     16-Jun-03      79609
**    Reconstruct read with preserved metadata - PCR 2282
**  Colleen Stouffer     09-Jul-03      79609
**    Fix BEAM issues - uninitialized pointers
**  Paul Richards        22-Aug-03      85805
**    Convert all ER #includes from rs*.h to er*.h
**
**-------------------------------------------------------------------------*/
```